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General Certificate of Secondary Education

Additional Science 4408 / Physics 4403

PH2HP Unit Physics 2

Report on the Examination

2012 examination – June series

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Additional Science / Physics
Higher Tier PH2HP

General

It seems that the standard of handwriting is getting more and more difficult to read with some students still using a blue pen or a pencil. Some students have such small writing that even when magnified it is still indistinct.

Students should try to ensure that answers are written in the space provided. In the situation where students are unable to complete their responses within the allotted space, they must provide a clear indication that their response to the question is continued elsewhere in the booklet or on supplementary additional pages.

There seems to be a general misconception that any straight line graph shows direct proportionality, whether the line passes through the origin or not.

Students should be encouraged not to waste time starting every answer by copying out the stem of the question.

Question 1 *(Standard Demand)*

(a) (i) This was a disappointing start to the paper with only a third of students scoring the mark. The majority of students chose the letters A and C, giving the total length of the extended spring and not the extension.

(a) (ii) Just over half of students were able to give the form of energy stored in the spring. However, many students only wrote either 'potential energy' or 'elastic energy' and so did not score the mark.

(b) (i) Only a few students scored both marks, with under a fifth of students scoring one mark. The majority of the students seemed concerned that a couple of the points were not exactly on the line or that the straight line suddenly curved upward.

(b) (ii) Most of students were able to place the letter P in the correct position on the graph line, of these students nearly two-thirds could give a correct reason for their choice. Most incorrect responses showed placement of the letter at either the last point recorded by the student, or at a point where the graph line reached the top of the grid of the graph paper.

(c) Only a fifth of students scored both marks in this question. Unfortunately, the vast majority of the students, failed to notice that the unit for the spring constant in the stem of the question was in newtons per metre, and simply multiplied the spring constant by the extension, which was in millimetres. When calculated correctly, these students and those who made errors in their unit conversion, were able to score one mark.

Question 2 *(Standard Demand)*

(a) (i) It is perhaps surprising that only two-thirds of students scored this mark. Many students failed to read the question carefully and gave an answer of 2.5, the total dose received.

(a) (ii) Most students scored one mark, usually for a response associated with flying, but only half of which went on to score both marks. Most errors were due to lack of detail, for example, working in a power station rather than a nuclear power station, or simply living in an area with a high background level without specifying the source of that increased level.

(b) (i) Almost two-thirds of students scored this mark. The most popular correct response was the idea of a control. The most common error was stating 'to compare smokers to non-smokers' with no reference to radon gas.

(b) (ii) Just over half the students scored one mark for making the simple link between exposure to radon gas and the increased risk of cancer. Less than a third of students made a correct link to smoking increasing the harmful effect of the radon gas exposure.

(c) This question was generally well answered with just over half of students scoring both marks a further quarter of students scoring one mark. Those students scoring no marks often simply described the shape of the graph line rather than identifying the differences between the two models.

(d) Just over half of students scored both marks often producing a well written balanced view. A further third of students scored one mark.

Question 3 *(Standard Demand)*

(a) Virtually all students scored at two marks for the calculation. Just over half of students scored all three marks for the question. The most common error was to give the unit of weight as kg or N/kg.

(b) Although many students wrote a lot, often by simply by repeating the same thing, few produced a logically sequenced, reasoned answer. Only a tenth of students achieved Level 3 to score either five or six marks. Many students failed to read the question carefully enough and so hardly mentioned, if at all, anything to do with forces. Common mistakes included writing about gravitational potential energy or kinetic energy balancing as a force, commenting on momentum and that terminal velocity was not reached until after the parachute had been deployed. Most students understood that velocity was reduced by opening the parachute, but were unable to explain why. Many students finished mid-sentence, with no indication that the answer continued elsewhere. The best answers, being well thought out and with a clear sequence, were usually written within the space available.

(c) (i) This was well answered with the vast majority of students scoring the mark. Common incorrect answers included simply stating 'the clay' rather than any of the variables pertaining to the clay, height of drop, and area of parachute.

(c) (ii) Of the three parachutes illustrated, the correct choice of parachute C was made by most students. However, less than half of students gave the reason in terms of a comparison of the relative surface areas and relative rates of descent.

Question 4 *(High Demand)*

(a) This question was well done with nearly all of the students scoring both marks.

(b) This question was not well answered for a variety of reasons. Some students simply did not know where to start, whilst others tried using momentum. Also, many realised the need to use the equation for kinetic energy, but were then unable to transform it or failed to square root; 300 was a common incorrect answer. Few students stated that GPE = KE although they used their answer from part (a) in the calculation. Only a tenth of students were able to complete the calculation and give an answer with an appropriate number of significant figures.

(c) Most students scored one mark for mentioning friction, but very few students were able to give a complete explanation to score all three marks. The idea that work would be done against friction was hardly ever mentioned. A significant number of students thought that the reduced maximum speed was due to the change in angle of the slide and the slide becoming horizontal.

Question 5 ***(High Demand)***

(a) Only just over half of students were able to give an acceptable meaning for electric current. There were many vague answers such as 'the flow of electricity'. Very few students, were able to give the meaning of potential difference. Common errors often included the idea of a force pushing the electricity around.

(b) This question was poorly answered. Very few students referred to free electrons at all. Most students gained one mark for an answer linking the increasing p.d. to the temperature however, few went on to then link this to the resistance increase. A significant number of students thought that the resistance caused the p.d. Those students who tried to explain resistance in terms of electrons colliding more often as the ions vibrate faster found it difficult to express themselves clearly. Many students had 'start' to vibrate and 'start' to collide, implying this was not happening before. Others had ions moving, rather than vibrating. Some students linked resistance to it being harder for electrons to pass, without giving any explanation why.

(c) About half the students scored both marks. The most common error was to misread the graph scale when obtaining the current at 6 volts. However, students that did misread the graph could still score one mark by showing a correct calculation using their incorrect value.

Question 6 ***(High Demand)***

(a) Many students were able to recall that main sequence stars undergo nuclear fusion, although there were a number of students who thought that protostars also undergo fusion, but at a slower rate. The spelling of fusion was not always clear, with some students putting a dot / dots above what may have been the letter 'u' or 'ii'; this was taken as being fission and so did not score a mark. Many students were aware that protostars are not giving off energy / radiation whilst main sequence stars are. A small number of students attempted to describe the life cycle of a star.

(b) Surprisingly, less than two-thirds of students knew fusion was involved. Many students had hydrogen fusing to form the heavier elements, rather than helium. Few students recalled that elements heavier than iron are formed in a supernova. A significant number of responses allocated a role to the planets and made reference to the 'Big Bang'.

Question 7 *(High Demand)*

(a) (i) This question was poorly answered with only a third of students completing the calculation correctly. Many students missed the information that the scales contained two cells and so used 3 V in the calculation. A large number of students were unable to convert mA to A. Some students chose the correct equation, but were unable to transpose it correctly. It was extremely disappointing that only a tenth of students were able to give the unit for resistance.

(a) (ii) This question was poorly answered by most students. Many students made reference to other tissues, such as muscle, but were unable to relate this to changes in body fat or body resistance. Common errors included responses relating to clothing and responses in terms of the inaccuracy of the apparatus or lack of precision.

(a) (iii) A small number of students correctly identified the water would cause a change in body resistance and so give misleading values. Many students however, took this idea further and suggested a risk of electrocution or internal burns because water was a good conductor. A significant number of students simply stated that you would weigh more because you had drunk the water.

(b) (i) Very few students were able to write that the RCCB works by detecting a difference between the current in the live wire and the current in the neutral wire. However, many students were able to score this mark by giving the alternative answer that the RCCB could be reset. A small number of students were under the impression that an RCCB is a type of fuse or that it contains a fuse inside. Over half of students were able to score a mark by stating that the fuse melts / blows. However, students should be aware that other descriptions such as, breaks, explodes, snaps and bursts are not acceptable.

(b) (ii) There were few responses where the student had calculated from the graph that the RCCB had to switch off within 60 milliseconds. Many students seemed to have missed the instruction to use information from the diagram or did not understand the significance of the difference in the current in the live and neutral wires. A number of students did gain a mark for the idea that the RCCB was fast, quick or acted immediately. Some students thought that 'automatically' was the same as fast. A few students misunderstood the graph and thought incorrectly that the RCCB switched the circuit off faster if the current was higher.

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